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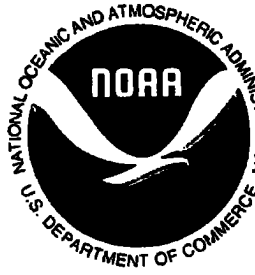

High-Resolution Infrared Radiation Sounder (HIRS) Level 1b Format Differences

Version 1.1

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1 Purpose

This document lists the modifications made to the current HIRS 1b format, referred to as the "NOAA-KLM 1b format", to create the new 1b format, referred to as the "NOAA-N/Metop 1b format", to be implemented for the launch of NOAA-N. Therefore, it essentially identifies the differences between these two formats. When implemented, the new NOAA-N/Metop 1b format will be applicable to all 1b data sets produced from the NOAA-KLMNN' and Metop satellites. This document also identifies those modifications to the previous release of the NOAA-N/Metop HIRS 1b format (dated June 13, 2003) that were made as part of the creation of this new 1b format. These modifications are specified in *italic* type.

2 Documentation Updates

- Added indications of fields that are applicable to just NOAA or just Metop.
- Added indications of fields that are applicable to just NOAA-KLM or just NOAA-NN'/Metop (usually shown in this document as "NOAA-N/Metop").
- Added Metop and NOAA-NN' spacecraft IDs in "Spacecraft Identification Code" field (byte offset 73-74) in header record. Renamed this field from "NOAA Spacecraft Identification Code" since Metop IDs are now included.
- Updated values for "Instrument ID" field in header record (byte offset 75-76) to include the instrument IDs of the NOAA-NN' and Metop-1/-2 satellites.
- Updated values for "Data Source" field in header record (byte offset 155-156) to include new source of data (e.g., Svalbard).
- Under "Data Verification Binary Code" field in data record (byte offset 4491-4524), listed the 17 decimal values contained in this field.
- Added note to "Radiometric Data for Element 0" field in data record (byte offset 1461-1500) describing how to unpack the HIRS radiometric data.
- The 4-byte data record field "Scan Line Quality Flags" (bytes 33-36) was split into four separate 1-byte fields. Only the way this field has been organized and documented in the format has changed. Its content and the location of each of its individual flags remain unchanged. The four "new" fields are
    - "Scan Line Quality Flags [<Reserved>] (zero fill)" (byte 33),
    - "Scan Line Quality Flags [Time Problem Code]" (byte 34),
    - "Scan Line Quality Flags [Calibration Problem Code]" (byte 35), and
    - "Scan Line Quality Flags [Earth Location Problem Code]" (byte 36).

3 Header Record Modifications

- *Defined new field, "Offset between Start of Scan and Center of First FOV", in bytes 109-110. (These were spare bytes.) It is a single two-byte integer, and is the time, in milliseconds, between the start of the scan and the center of the scan's first FOV. It is included to aid a user in converting a 1b's scan line time back to the value as originally reported by the spacecraft.*
- *Defined new field, "Instrument Type", in bytes 111-116. (These were spare bytes.) It is a 6-byte character field, and indicates the type of the HIRS instrument (e.g., 'HIRS/3' or 'HIRS/4').*

- Added definitions for bits 0 and 1, which were previously undefined (zero fill), of "Earth Location Error Code" (byte offset 151-152). These are defined the same as in "Scan Line Quality Flags [Earth Location Problem Code]" in data record (see below).
- "Ramp/Auto Calibration Indicators Bit Field" renamed to "Auto Calibration Indicators Bit Field" (byte offset 187-188) and description of meaning of the "auto calibration override switch for HIRS/4" bit added. This field is based on the pre-NOAA-K header field of a similar name. The pre-K 1b headers were all the same. Thus this field meant one thing for AVHRR and a different thing for HIRS. The "ramp" portion of this field name is applicable to AVHRR, and thus eliminated here in the HIRS 1b specification.
- *The scale factors of the header fields "Albedo-radiance Ch 20 Solar Filtered Irradiance" and "Albedo-radiance Ch 20 Equivalent Filter Width" (byte offset 749-752) were changed from 6 to 2 and from 6 to 4, respectively. This was necessary because the values of these fields are being truncated due to incorrect scale factors.*
- *Changed bit 0 of the "Earth Location Bit Field" (byte offset 771-772) from "attitude error correction (0=not corrected; 1=corrected)" to "constant attitude error correction (0=not performed; 1=performed)". Defined bit 2, which was previously undefined, as "dynamic attitude error correction (0=not performed; 1=performed)".*
- Increased word sizes of "Analog Telemetry Conversion" coefficients (byte offset 857-1240]) from 2 bytes to 4 bytes to allow for more and better precision.
- Added a new "Digital A Telemetry Conversion" section (byte offset 1241-1884) to hold the digital A telemetry conversion coefficients.
- *To make applicable for both NOAA-KLM and NOAA-N/Metop, the following changes were made to the "Digital A Telemetry Conversion" coefficients:*
    - *Identified that the 6 coefficients for "Internal Warm Target, Temperature Sensor #5"(byte offset 1337-1360) are only applicable for NOAA-N/Metop and will be spare (zero fill) for NOAA-KLM.*
    - *Added 6 coefficients for "Internal Cold Target, Temperature Sensor #2" through "Internal Cold Target, Temperature Sensor #4" (byte offset 1385-1456), indicating that these are only applicable for NOAA-KLM and will be spare (zero fill) for NOAA-N/Metop.*
    - *Mentioned that "Tertiary Telescope Temperature Sensor Coefficients" (byte offset 1457-1480) are applicable for NOAA-N/Metop only, and will be spare (zero fill) for NOAA-KLM.*
- *Added a new "Lunar Contamination" section (byte offset 1885-1968). It is located in what were spare bytes, and contains the following three new fields:*
    - *"Count of Scans Containing Lunar-Contaminated Space Views" -- A single 2-byte integer field.*
    - *"Lunar Angle Threshold" -- A single 2-byte unsigned scaled-integer field.*
    - *"24-Hour Average Space View Counts" -- A field of 20 unsigned 4-byte integers. NOTE: In the June 13, 2003 release of the NOAA-N/Metop HIRS 1b format this field was defined in bytes 545-624. With this release, the field has been moved to its current location.*
- *The following fields, related to Metop maneuvers, were added in the filler area at the end of the header record:*
    - *"Start of Maneuver Year" (byte offset 1969-1970).*
    - *"Start of Maneuver Day of Year" (byte offset 1971-1972).*

- *"Start of Maneuver UTC Time of Day" (byte offset 1973-1976).*
- *"End of Maneuver Year" (byte offset 1977-1978).*
- *"End of Maneuver Day of Year" (byte offset 1979-1980).*
- *"End of Maneuver UTC Time of Day" (byte offset 1981-1984).*
- *"Change in Spacecraft Velocity" (byte offset 1985-1996).*
- *"Spacecraft Mass" (byte offset 1997-2004).*

4 Data Record Modifications

- *Unused (reserved) byte of the "Scan Line Quality Flags" field (byte offset 33) changed to contain additional calibration problem indicators (now named "Scan Line Quality Flags [Additional Calibration Problem Code]").*
  - *Defined bit 7 as the flag "scan line was not calibrated because of satellite maneuver (Metop) or <zero fill> (NOAA)". (NOTE: In the June 13, 2003 release of the NOAA-N/Metop HIRS 1b format, this flag was defined in bit 0 of the "Scan Line Quality Flags [Calibration Problem Code]" field (byte offset 35).)*
- *Made the following set of changes to the "Scan Line Quality Flags [Calibration Problem Code]" field (byte offset 35):*
  - *Changed wording of bit 1 from "moonlight detected in space views; using daily orbital average space counts for calibration" to "space view scan contains one or more readings that are lunar contaminated (equals zero if internal target scan or earth scan). (TBC)".*
  - *Defined bit 0 as "lunar-contaminated space view scan was able to be corrected (only applicable if the previous flag [bit 1] is 1; otherwise, zero). (TBC)"*
- Added definitions for bits 0 and 1, which were previously undefined (zero fill), of "Scan Line Quality Flags [Earth Location Problem Code]" (byte offset 36). They are now defined as follows:
  - bit 1: "not earth located because of satellite in-plane maneuver (Metop) or <zero fill> (NOAA)"
  - bit 0: "not earth located because of satellite out-of-plane maneuver (Metop) or <zero fill> (NOAA)"
- *Updated definitions of all bits/flags in "Scan Line Quality Flags [Calibration Problem Code]" (byte offset 35) for consistency with the new Version 4 calibration algorithm.*
- *Updated definitions of all bits/flags in "Calibration Quality Flags" (byte offset 37-76) for consistency with the new Version 4 calibration algorithm.*
- *Added the following two new navigation-related field. They are located in what were spare bytes. The preceding spare (zero fill) field were eliminated to accommodate these new fields.*
  - *"Computed Yaw Steering" (bytes 637-642)*
  - *"Total Applied Attitude Correction" (bytes 643-648)*
- *Defined the following bits, which were previously undefined (zero fill), of "Navigation Status Bit Field" (bytes 649-652):*
  - *bits 20-19: "yaw steering parameters usage indicator"*
  - *bit 18: "Metop maneuver indicator"*
  - *bit 17: "earth location at the satellite subpoint is accurate and reasonable"*
- *For consistency and clarity, references to "Local azimuth angle" in the "Angular Relationships" field (byte offset 665-1000) changed to "Satellite azimuth angle".*

- *Added a new field, "Lunar Angle" (bytes 1449-1450). It is located in what were spare bytes.*
- Modified contents of element 59 because of changes in the HIRS/4 data stream. In particular,
    - Replaced the first "Space View" (byte offset 4293-4302) with "Internal Cold Target, Temperature Sensor #1".
    - *Defined bytes 4303-4312 as either "Internal Cold Target, Temperature Sensor #2", if NOAA-KLM HIRS/3 data, or "Analog Ground 3", if NOAA-N/Metop HIRS/4 data.*
    - *Defined bytes 4313-4322 as either "Internal Cold Target, Temperature Sensor #3", if NOAA-KLM HIRS/3 data, or "Internal Warm Target, Temperature Sensor #5", if NOAA-N/Metop HIRS/4 data.*
    - *Defined bytes 4323-4332 as either "Internal Cold Target, Temperature Sensor #4", if NOAA-KLM HIRS/3 data, or "Tertiary Telescope Temperature Sensor", if NOAA-N/Metop HIRS/4 data.*